in the loss of several hundred chickens, were reported to the writer and experiments in feeding rose chafers to chickens were taken up at the Storrs Agricultural Experiment Station in 1909.

The deaths from this diet usually occurred in from nine to twenty-four hours after feeding. This led the writer to believe that undoubtedly death resulted from a cause other than a mechanical injury to the crop or "crop bound" condition. An extract was made from crushed rose chafers and distilled water, filtered, and fed to chickens in varying doses with a medicine dropper and this resulted in a great many deaths. Small chickens died in a few hours after feeding, older chickens of heavier weight when fed a small quantity of the extract lived but showed signs of poisoning; large doses resulted in their deaths. Mature hens did not die from the extract.

From 150 to 200 chickens have been fed either with the rose chafers or with varying strengths of the extract to determine the weight of the chicken killed by a certain amount of poison, also to determine the age limit of the chickens killed.

The results may be summarized as follows: 15 to 20 rose chafers are sufficient to cause the death of a chicken one week old. From 25 to 45 rose chafers are usually necessary to kill a three-weeks-old chicken. While some nine-weeks-old chickens have been killed by eating rose chafers, only one ten-weeks-old chicken was killed in these experiments. In the crop of this chicken there were 96 undigested rose chafers counted in post-mortem examinations.

The chickens feed upon the insects ravenously, being attracted by their sprawly appearance and usually within an hour after eating they assume a dozing attitude, later leg weakness shows and the chicken usually dies within twenty-four hours of having eaten these insects, or begins to improve after this time.

In less than five per cent. of the deaths convulsions occurred. Post-mortem examinations showed no abnormal condition of the organs. In order to exclude the possibility of arsenical poisoning due to the rose chafers having fed upon leaves that have been sprayed, tests were made by a chemist for arsenic, but no evidence of arsenic was found.

Intravenous injections were made in these experiments, extracts for injection being made from forty grams of rose chafers and sixty c.c. of a salt solution having a specific gravity of .9 per cent. This extract was put in a centrifuge for five minutes, the extract drawn off in a pipette and filtered in vacuo. Three c.c. of this extract were injected into a 690-gram rabbit intravenously and this died in six minutes. Another rabbit, weighing 1.435 grams, died in three and one quarter minutes after an injection of four c.c. A small 610-gram rabbit, when injected with two and one half c.c., died in fifty-five seconds after injection, and a large 1,450-gram rabbit died in two hours and thirty-five minutes after being injected with two c.c. Other rabbits were injected and killed by this extract, but further work needs to be done to determine what is a lethal dose for rabbits and experiments in feeding rabbits per os will be taken up next summer.

As nearly as the writer can determine, the rose chafers contain a neuro toxin that has an effect upon the heart action of both chickens and rabbits and is excessively dangerous as a food for chickens.

Owing to the fact that the insect feeds upon such a large number of plants, particularly on daisies, it seems essential that chickens be kept in mowed fields and away from yards having grape vines and any flowering shrubs during the month when the rose chafers are about, especially during years when rose chafers are particularly abundant.

GEORGE H. LAMSON, JR.
CONN. AGRICULTURAL COLLEGE,
STORRS, CONN.

THE AMERICAN SOCIETY OF ZOOLOGISTS

THE American Society of Zoologists held its thirteenth annual meeting jointly with Section F and in affiliation with the American Society of Naturalists, December 28, 29 and 30, 1915, in Townshend Hall, Ohio State University, Columbus, Ohio.

BUSINESS SESSION

New Members

At the session for the transaction of business, held on the afternoon of December 29, President Wm. A. Locy presiding, the persons who had been nominated for membership in the society and who were recommended for election by the executive committee, were duly elected. A list of the names of these newly elected members follows:

Leslie Brainerd Arey, Northwestern University Medical School, Chicago, Ill.

George William Bartlemez, University of Chicago, Chicago, Ill.

William John Crozier, Bermuda Biological Station, Agar's Island, Bermuda.

Rhoda Erdman, Yale University, New Haven, Conn.

J. F. Gudernatsch, Cornell University Medical School, New York City.

L. V. Heilbrunn, University of Chicago, Chicago, Ill.

Julian Huxley, Rice Institute, Houston, Texas.

Roscoe R. Hyde, State Normal School, Terre Haute, Ind.

Sidney I. Kornhauser, Northwestern University, Evanston, Ill.

George N. Papnicolaou, Cornell University Medical School, New York City.

Frank H. Pike, Columbia University, New York City.

William Albert Riley, Cornell University, Ithaca, N. Y.

Reynold Albrecht Spaeth, Yale University, New Haven, Conn.

Olive Swezy, University of California, Berkeley, Calif.

Morris Miller Wells, University of Chicago, Chicago, Ill.

J. E. Wodsedalek, University of Idaho, Moscow, Idaho.

Sewall Green Wright, Department of Agriculture, Washington, D. C.

Officers

The ticket agreed upon by the committee on nominations, appointed by President Locy and consisting of C. M. Child, George Lefevre and Raymond Pearl, was approved by the society and officers were elected as follows:

For president during the year 1916, D. H. Tennent.

For vice-president during the year 1916, Charles Zeleny.

For member of the executive committee to serve five years, R. P. Bigelow.

For member of the executive committee to take the place vacated by the president-elect, L. J. Cole.

Report of Secretary-Treasurer

Financial Statement:

Balance and Receipts

Balance on hand January 1, 1915	$689.15
Dues received from members during the year 1915	273.10
Interest on deposits in Title Guarantee and Trust Co.	30.56
Dividend on fund in Industrial Savings and Loan Co. from J. H. Gerould, trustee	15.00
Total	$1,007.81

Disbursements

2,028 stamped (2 c.) special envelopes ..	$43.32
605 stamps (2 c.)	12.10
Typewriting (circular letters, addresses, etc.)	19.15
Typewriter supplies	1.00
Express charges	5.69
750 Columbia clasp envelopes	6.75
350 copies printed list new members	19.33
700 copies blank due bills	3.00
350 copies proceedings 1914 meeting	13.98
350 copies announcements 1915 meeting.	7.10
1,000 nomination blanks	8.25
500 copies of program for 1915 meeting.	16.90
Expenses of Sec'y-Treas. at 1915 meeting.	41.56
Total disbursements	$198.13
Total amount received	1,007.81
Balance on hand Dec. 29, 1915	$809.68

Unpaid Dues

Number of members with dues in arrears:		
For the years 1913, 1914, 1915...	1....	($3.00)
For the years 1914 and 1915 ...	12....	($24.00)
For the year 1915	41....	($41.00)
Total	54....	($68.00)

Section Established

For the information of the Society it was reported that a permanent Pacific Section of the American Society of Zoologists was organized last summer which cooperated with the American Association for the Advancement of Science in holding a successful zoological meeting in connection with the Panama Exposition in San Francisco.

Conflict between Zoologists and Naturalists in Time of Holding Meetings for Reading Zoological Papers

The secretary also reported that the executive committee has been unsuccessful in its attempt to arrange with the executive committee of the American Society of Naturalists a plan whereby the two societies will not schedule simultaneous sessions for the reading of papers of interest to members of both societies, and, after some discussion, the following motion by H. S. Jennings was passed by this society.

The society recommends to the executive committee the desirability of consulting with officers of the American Society of Naturalists, Section F, and the Botanical Societies, as to the formation of a union section for the presentation of papers in genetics and evolution, this section, if need be, to hold meetings parallel with those of other sections of the societies.

Committee on Premedical Education

A report from the committee on premedical education having been called for, H. B. Ward, chairman of the committee, explained satisfactorily the delay in presenting a report.

The society, after some discussion, expressed its hope that there will be a continuation of the discussion of the subject of premedical education between the committees appointed for this purpose by the American Societies of Zoologists and Anatomists, which will result in substantial agreement and a specific report.

Committee on Memorials

The committee appointed at the last annual meeting to prepare suitable memorials of Seth Eugene Meek and Charles Sedgwick Minot, deceased members, submitted the following, which were adopted and ordered to be placed with the minutes of this meeting and published with the proceedings.

Seth Eugene Meek

April 1, 1859—July 6, 1914

Dr. Seth Eugene Meek was born in Hicksville, Ohio, April 1, 1859, of Scotch parentage. He studied at Valparaiso University and obtained the degree of S.B. in 1881. Continuing his studies at the University of Indiana he received the degree of S.B. in 1884 and M.A. in 1886. He was a Fellow at Cornell University from 1885 to 1886, and was granted the Ph.D. degree from the University of Indiana in 1891.

He married Ella E. Turner, December 25, 1886. He held the following positions: Professor of natural sciences, Eureka College, 1886–1887; Coe College, 1887–92; assistant professor of biology and geology and curator of the museum, University of Arkansas, 1892–96; curator of ichthyology, Field Columbian Museum, 1897 until the time of his death. He studied at the Naples Laboratory in 1896–97, and was in the employ of the United States Bureau of Fisheries in the summers from 1887 to 1897.

He carried out numerous explorations for ichthyological data, especially concerning the geographical distribution of fishes in Canada, the central and western United States, Mexico, Guatemala, Nicaragua, Costa Rica and Panama. He acted as ichthyologist for the Biological Survey of Panama in 1911–12.

His scientific publications comprise over seventy papers, dealing largely with the taxonomy and geographical distribution of American fishes. His best work is probably that on the fresh-water fishes of Mexico and Central America; especially his memoir published in 1904 on the fresh-water fish of Mexico north of the Isthmus of Tehuantepec; besides dealing with the taxonomy this memoir contains an important analysis of the geographical distribution of fishes and includes descriptions of many new species. His previous work in Central America, especially in Guatemala and Nicaragua, had given a basis of experience which enabled him to speak with authority, and would, no doubt, if his life had been spared, have led to valuable generalizations upon geographic and faunistic problems.

He was a careful and enthusiastic worker, a man of genial temperament and slow to anger, cautious and judicial in his attitude on doubtful questions.

The American Society of Zoologists puts this minute on record, and expresses its deep regret at the too early loss of such an honored member.

Charles Sedgwick Minot

1852–1914

In the death of Dr. Charles Sedgwick Minot the American Society of Zoologists has lost a valued and honored member and science an able and trusted worker.

The society, therefore, desires to place on its records the following minute in recognition of his services to science and to mankind.

Born to leadership, with an unusual talent for organization, Dr. Minot took a leading part in the foundation of a number of societies for the advancement of biological research. Amongst these

was the American Morphological Society, the forerunner of the American Society of Zoologists, and in the year 1896–97 he was its president. Later, when his interests lay rather in the field of anatomy and medical education, his scientific work retained the character of its earlier days and still commanded the interests of the wider circle of biologists. From the very beginning of his career, his mind showed a grasp of the larger problems of science, and while accurate and painstaking to an unusual degree, his incisiveness of thought and expression, and his broad outlook stood out as his predominant characteristics. Ever ready to help with sound advice or arduous labor any enterprise for the advancement of his chosen field, he was not one to shirk the disagreeable duties of life or to gloss over with fine words things that were not right. He voiced his opinion courageously and effectively when occasion called, but his criticism, though keen, was constructive and his active cooperation was always welcome and often indispensable—a true and helpful comrade, a wise and fearless leader.

Propositions from Wistar Institute

After a general discussion of the following offer made by the director of the Wistar Institute, Dr. Milton J. Greenman, to the members of the society in order to secure more permanent support and general distribution of zoological journals published by the Wistar Institute—"*that we* (the Wistar Institute) *offer to members of the American Society of Zoologists, all issues of the Journal of Experimental Zoology* (two volumes per year, present price $10.00) *or all issues of the Journal of Morphology* (about one and one third volumes per year, price $12.00) *for $4.50 in yearly dues per member to be paid by the society*"—the society instructed its executive committee to secure, if possible, an offer more nearly the equivalent of that made to the membership of the American Society of Anatomists, subject, however, to modification such as to permit those members who are also members of the American Society of Anatomists, to secure for $4.50 the issues of the journal they do not receive by virtue of dues to the American Society of Anatomists, all other members to pay $6.50, through the American Society of Zoologists and receive all issues of four journals.

In case such an offer is secured, the executive committee was given power to increase the annual dues to $5.00 or $7.00, as the case may be, and to enter immediately upon such an agreement.

Fahrenheit Thermometer Bill

The question of passing a resolution favoring favorable action by congress upon the bill for abolishing the use of the Fahrenheit thermometer in government publications was presented and being informed by H. B. Ward that the advisability of passing such a resolution is being debated by the Physicists, within whose field the subject more properly belongs, the society decided to take no action.

Concilium Bibliographicum

The urgent need of the Concilium Bibliographicum for funds at the present time, due to conditions in Europe caused by the war, to enable it to continue its work, was presented by E. L. Mark, and upon his motion the secretary-treasurer was instructed to forward to the Concilium Bibliographicum, Zurich, Switzerland, from funds in the treasury the sum of two hundred dollars.

Invitation to Meet in Minneapolis

A cordial invitation from men of the various scientific departments of the University of Minnesota to meet at some time in the near future in Minneapolis was transmitted to the society through H. F. Nachtrieb. The secretary was instructed to bring this invitation to the attention of the executive committee, and the hope was expressed that the next meeting in western territory may be held in Minneapolis.

List of Officers and New Members

The secretary was authorized to print and distribute lists of officers and new members and to make such corrections to the list of members as may be necessary.

Sessions for Reading Papers

Sessions for reading papers listed on the program were held on the forenoon and afternoon of Tuesday, December 28, and on the forenoon of Wednesday, December 29. Vernon L. Kellogg, vice-president of Section F, presided at the session held on the afternoon of Tuesday; Wm. A. Locy, president of the Zoologists, presiding at all other sessions.

A list of the papers read in full or by title, together with abstracts of each paper, classified according to general subjects, follows:

ECOLOGY

The Effect of Certain Ions on Rheotaxis in Asellus (illustrated with lantern): W. C. Allee, Lake Forest College.

Of the kations tested, potassium and rubidium

alone cause a strong increase in the positiveness of the rheotactic reaction of the isopod, *Asellus communis* Say. Sodium has a similar but less pronounced effect. The efficiency of the chlorine salts in causing this change is:

$$Cs < Li < Na < Rb < K,$$

or, arranging in order of their chemical activity:

$$Li < Na < K > Rb > Cs.$$

The anions also affect the rheotactic reaction. In a series of potassium salts KCl gives the greatest increase in positiveness. The favorableness of the anions tested is:

$$Br, I, No_3 < CH_3Coo, < ClO_3 < SCN < Cl,$$

with chlorine much more favorable than its nearest competitor. The relative toxicity of neither the anions nor kations runs parallel with their relative effect on rheotaxis.

Any ion in the concentrations (usually $N/.5 - N/10$) used in these experiments will cause a decrease in the positive rheotactic reaction if allowed to act for sufficient time. Calcium almost always causes this depression without a preliminary increase. Strontium and barium act similarly, but magnesium often stimulates before depressing.

By alternating an isopod between $N/10$ solutions of KCl and $CaCl_2$ its rheotactic reaction has been alternately increased and decreased as many as seven times in the six hours before the animal succumbed to the treatment.

Negative isopods treated with KCl until strongly positive have their resistance to $N/400$ NaCN decreased, which indicates that their rate of metabolic activity has increased. $CaCl_2$ has exactly the opposite effect. These results support earlier work on the relation of rheotaxis and metabolism in *Asellus*.

Glacier Oligochæta from Mt. Rainier (illustrated with lantern): PAUL S. WELCH, Kansas State Agricultural College.

Mesenchytræus solifugus (Emery, '98; Moore, '99; Eisen, '05) and *Mesenchytræus niveus* (Moore, '99), found on certain Alaskan glaciers, are apparently the only recorded Oligochæta which normally inhabit snow and ice. Six collections, January 7 to June 17, 1915, from the snowfields and glaciers of Mt. Rainier, Washington, contain an undescribed enchytræid (*Mesenchytræus gelicus* n. sp.) which occurs abundantly in that very unusual habitat. Among the remarkable structural characters of this worm, the extent and complexity of the reproductive organs are perhaps most noteworthy. A pair of very large spermathecæ extends from IV./V. to XI., almost completely filling the cœlom, and containing surprising quantities of spermatozoa. A pair of well-developed sperm sacs, extending from XI./XII. to XXXV. and containing large masses of developing spermatozoa, are surrounded by a large ovisac which extends from XII./XIII. to XXXV. and contains in addition large quantities of developing ova. The penial bulb is very complex in organization. The specimens are very dark in color, due to the large amount of pigment in the hypodermis. Certain internal organs, especially the spermathecæ, chloragog cells and lymphocytes also contain pigment granules. The collections also contain specimens of *M. solifugus* Emery, a form which occurs in abundance on the permanent snow and ice fields of Mt. Rainier. Evidence points to certain snow algæ as one of the chief sources of food for both of these worms.

The Reaction of Fishes to Stimuli not Encountered in their Normal Environments: V. E. SHELFORD, Illinois State Laboratory of Natural History.

Wastes from the manufacture of illuminating gas are commonly thrown into streams and are probably more generally fatal to fishes than any other industrial wastes. In course of the investigation of the effects of products of the destructive distillation of coal upon fishes about twenty-five compounds have been studied. Nearly all are rapidly fatal when present in minute quantities. The reactions of fishes to these ingredients have been tested and the fishes tested are positive to fifteen of the twenty-five compounds, indefinite or indifferent to seven and negative to only two or three. Thus the reactions of the fishes are of such a nature as to destroy rather than to preserve them.

COMPARATIVE AND GENERAL PHYSIOLOGY

The Relation Between Wave-length and Stimulation in the Lower Organisms: S. O. MAST, Johns Hopkins University.

The relative stimulating effect of different regions of a spectrum having a known distribution of energy was ascertained for the following fifteen species: *Chlamydomonas, Trachelomonas* and *Phacus,* each one species; *Pandorina, Eudorina, Gonium* and *Spondylomorum,* each one species; earthworms, *Arenicola* (larvæ) and blowfly (larvæ) each one species.

The results obtained are briefly stated below

without corrections for the difference in the energy of these regions. They are, however, of such a nature that the corrections mentioned will not result in marked alterations.

For all but one of the microscopic organisms the results fall into two groups. In the one group the region of stimulation begins in the blue near the violet, between 430 $\mu\mu$ and 440 $\mu\mu$. From here toward the red end of the spectrum the stimulating efficiency rises, at first slowly and then rapidly, to a maximum in the green near the yellow, between 530 $\mu\mu$ and 540 $\mu\mu$; then it falls, at first rapidly and later more and more slowly, ending in the red at about 640 $\mu\mu$. In the other group the region of stimulation begins in the violet between 420 $\mu\mu$ and 430 $\mu\mu$, only a short distance from the place where it begins in the first group. From here the efficiency rises very rapidly, reaching a maximum in the blue between 480 $\mu\mu$ and 490 $\mu\mu$. It then falls rapidly and ends in the green in the neighborhood of 520 $\mu\mu$. Three of the microscopic forms, *Pandorina, Eudorina* and *Spondylomorum,* belong to the first group, the rest to the second. To this group belong also *Arenicola* larvæ and the earthworms. For the remaining microscopic form (*Chlamydomonas*) the maximum is in the green very near 510 $\mu\mu$; and for the blowfly larvæ it is approximately at 520 $\mu\mu$. The distribution in the spectrum, of stimulating efficiency is, for this creature, essentially the same as the distribution of brightness for color-blind persons.

These results show that stimulation in all of the organisms studied depends upon the wave-length of the light; that the stimulating efficiency is very much higher in certain regions of the spectrum than in others; but that the distribution of this in the spectrum differs greatly in certain organisms that are closely related in structure, *e. g., Pandorina* and *Gonium,* while it is essentially the same in others that are very different in structure, *e. g., Euglena* and earthworms. They also have a bearing on the nature of the chemical changes associated with the reactions to light.

Negative Orientation in Vanessa Antiopa: Wm. L. Dalley, Jr., Randolph-Macon College. (Introduced by S. O. Mast.)

Certain photo-positive insects orient, on coming to rest in direct sunlight, so that they face directly away from the sun. Is this phenomenon dependent upon previous violent exercises, as Professor Parker holds, and is it a reaction to light or to heat?

Vanessa, which has been raised in a small cage and had never flown in the open, repeatedly oriented negatively in sunlight, as did also specimens with both eyes covered so that no light could enter. Moreover, normal animals exposed in darkness to heat-rays from an electric flatiron usually face away from the source of heat, and they respond in the same way even when the heat-rays are opposed by light-rays coming from the opposite direction. Furthermore, when normal animals are placed in a room the temperature of which is high (29° C. to 32° C.) they do not orient at all, no matter how they are illuminated.

These results seem to show that when *Vanessa* faces away from the sun on coming to rest in sunlight, it is reacting to heat and not to light, and that this reaction is not necessarily dependent upon previous violent exercise.

Electric Currents Generated in the Eye of the Fish by Light: Edward C. Day, Syracuse University.

The live fish, wrapped in a wet cloth, gills irrigated by a hose led into the mouth, was placed in a dark box. Electrodes were applied to the eye, one to the cornea and one to back of eye-ball, and connected with string galvanometer. When light struck the eye the galvanometer recorded electrical disturbances. By projecting the shadow of the string into a photographic apparatus its deflections could be recorded along with time and exposure curves. On-effect consists of a slight depression *A,* followed by a strong abrupt elevation *B* and another slower secondary rise *C.* Off-effect consists of an abrupt elevation *D.*

For dark-adapted eye all four deflections are present; *B* is always greater than *D.* For light-adapted eye *A* and *C* are absent; *B* is smaller than *D.* Latent period from onset of light to beginning of $A = 0.032''$, $B = 0.075''$, $C = 1\text{–}7''$; and from extinction of light to beginning of $D = 0.05''$.

Deflections may be resultant expression of interfering reactions of three substances in the retina.

Intermittent stimulation gives oscillatory curve composed chiefly of *A* and *D* deflections; 25 flashes per second evoked 25 oscillations, and oscillations blended at 28 flashes per second.

Changes in Thelia bimaculata (Fabricius) Induced by Insect Parasites (illustrated with lantern): S. I. Kornhauser, Northwestern University. (Introduced by Wm. A. Locy.)

In *Thelia* pronotum covers entire body, extending far in front of head as a horn and back over thorax and abdomen. It is coarsely punctured

over entire surface, being in the male dark brown with large lateral spot (vitta) of bright yellow on each side, and in the female gray with only faint indication of vitta.

In parasitized males, color of pronotum corresponds to that of normal female. Not only is yellow lost from vitta, but characteristic pigment of female develops. Vitta of normal male is yellow because chitin is transparent (shows no melanin even in punctures), allowing a yellow hypodermal pigment (non-melanic and easily destroyed by acids and other organic solvents) to shine through. Punctures have no yellow pigment below them. In female vitta is gray because punctures are brown (due to melanin in superficial layers of chitin), and hypodermal areas are partially filled with grayish residue in cells and greenish pigment unevenly scattered. These female characters are assumed by fully parasitized males and the degree of change depends upon how long before its final moult the nymph was parasitized. Thus all intermediate stages of disappearance of yellow pigment and assumption of melanin have been found.

Normal female of thelia is larger than normal male; and abdomen and wings, less melanic. Measurements of pronota, wings and abdomens, show that parasitized males are larger than normal males, but not as large as normal females. There is also a reduction of melanin in abdomen and wings of parasitized males. Abdomen assumes pointed form of female, and posterior chitinous rings increase in length.

Internally, testes undergo fatty degeneration, and are finally entirely lost (either before or after final moult), although cell divisions (often abnormal) continue up to last vestige. Entire abdomen of male becomes crowded with fat, in which parasites are imbedded. Normally only female abdomen contains much fat, while that of male is almost entirely filled with testes, vas deferens and seminal vesicles. Assumption of female secondary characteristics by male must be due not only to loss of primary sexual organs, but also to changed metabolism (laying on of fat) caused by action of parasites themselves.

Differentiation and Dedifferentiation in Bursaria and its Significance: E. J. LUND, University of Minnesota.

During the process of regeneration of pieces of *Bursaria* a simplification of structure of the cut piece always takes place previous to differentiation. A similar process is evident during encystment and excystment, during normal division and sometimes periodically during the life of a normal individual.

The only conceivable ways, looked at from the standpoint of physical science, that "regulation," "regeneration," "making over," etc., of a complex structure can take place is: (1) (*a*) that it is first *simplified* physico-chemically to a greater or less extent; (*b*) that the products resulting from simplification are necessary and sufficient for the production of a different structure; (*c*) that these parts (resultant products, perhaps amino acids or simpler proteins, etc.) be capable of *recombination* in a *different* way, or (2) that a stereoisomeric change takes place in the system. But the latter is obviously insufficient to account for the changes actually taking place in regulating structures, and is not what would be expected from a knowledge of many chemical facts of metabolism. This statement of regeneration processes does not imply that antecedent properties which determine the specific path of differentiation (determiners of heredity) of the morphologically non-differentiated cell do not exist, nor that they are variable or invariable if they do exist.

Light Reactions of Diemyctylus: A. M. REESE, West Virginia University.

Diemyctylus is negatively phototropic to a marked degree at ordinary temperatures. At a temperature near 0° C. and at a temperature of about 36° C., it is more or less indifferent to light. The response is the same when the light comes from below.

It is positively phototactic to lights of all intensities, though this seems to vary with the different seasons. Experiments are now under way to determine this. At low temperatures the phototaxis may be inhibited or reversed.

It responds to red, green and blue lights as to white light, the response being less marked to green than to red, and still less to the blue.

Diemyctylus responds promptly to a spot of sunlight thrown upon various parts of the body by a small mirror, as has been noted by the author for *Necturus* and *Cryptobranchus*.

On Loss of Cell Pigment as an Index of Permeability Changes: W. J. CROZIER, Bermuda Biological Station.

Experiments with tissues of the nudibranch *Chromodoris zebra* give evidence showing that, at least in this case, which has the advantage of being uncomplicated by strong muscular contraction, the outward diffusion of cell pigment can not be used to estimate permeability increase quantitatively. The speed with which the pigment appears

outside the cell varies with the degree to which the tissue is stretched. In studying a large number of acids, no parallelism could be discovered between their rates of entrance into the cell and the order of pigment loss in the different acid solutions. Using the penetration time of acids as a criterion of penetrability (their entrance being shown by the color change of the pigment, which is a "good" indicator for acids), instances have been found in which the speed of acid penetration is accelerated, while loss of pigment is delayed, and, reciprocally, permeability toward acids may be caused to decrease while the pigment diffuses out of the cell.

The Doubtful Validity of the Hypothesis of Warning and Immunity Color: W. H. LONGLEY, Goucher College.

This paper reports observations upon the color and color-changes of tropical reef-fishes of the West Indian region. The facts noted lead to the conclusions that the color of the fishes is very definitely correlated with their habits and that color-changes are adaptive. Of these ideas both seem incompatible with the conspicuousness hypotheses, but neither is at variance with the conception of concealing coloration.

Rate of Regeneration from New Tissues Compared with that from Old Tissues: CHARLES ZELENY, University of Illinois.

When a second removal of the tail of the frog tadpole is made at a level proximal to that of the first removal the tissue at the cut surface is the original old tissue. When the second removal is made distal to the first the cells at the cut surface are the newly regenerated ones. The levels of these cuts can be so regulated as to make possible a direct comparison of the rates of regeneration in the two cases. Such a comparison shows that there is no essential difference between the two rates, a slight advantage in favor of the regeneration from new tissues being probably not significant. In one of the experiments the specific amount of regeneration at the end of six days was .196 from old tissue and .204 from new tissue. At the end of eight days the corresponding figures were .303 and .310.

The result indicates that the primary factors controlling rate of regeneration are not those inherent in the condition of the cells which proliferate to form the regenerated tail. They are rather to be sought in the influence exerted by other parts of the organism.

The Function of the Efferent Fibers in the Optic Nerve of Fishes: LESLIE B. AREY, Northwestern University Medical School. (Introduced by G. H. PARKER.)

When the optic nerve only of *Ameiurus* is severed, the rods, cones and retinal pigment fail to execute their characteristic photomechanical responses. After hemisection of the nerve, movements of the elements occur only in that region of the retina adjacent to its intact side. It can not only be shown (since essentially normal responses occur in excised eyes and in eyes attached to the body by the optic nerve only) that a second mechanism exists in association with the muscles innervated by the oculomotor nerve, which inhibits these movements when the optic nerve is cut, but also that electrical stimulation of the peripheral stump of the optic nerve can overcome this inhibition.

Hence demonstrably functional efferent fibers exist in the optic nerve. Only by the balanced action of these components with a second extrinsic set of fibers (ciliary nerves?), which independently exert an inhibitory influence upon the movements of the retinal elements, are normal photomechanical responses accomplished. It is probable that efferent impulses in the optic nerve do not directly stimulate the retinal elements to motion, but rather act indirectly by blocking the tonic inhibition exerted by the second system. These efferent optic nerve fibers may be designated as visceral efferent nerve components.

Severance of the optic nerve of *Abramis* or *Fundulus* does not prohibit movements of the retinal elements, hence it is impossible to state whether the mechanism discovered in *Ameiurus* is or is not peculiar to that species alone.

The Relation of the Body Temperature of Certain Cold-blooded Animals to That of Their Environment: CHARLES G. ROGERS AND ELSIE M. LEWIS, Oberlin College.

A review of the literature upon the subject of the body temperatures of the so-called cold-blooded animals reveals a lack of uniformity of observations in part, at least, due to faulty methods of determination.

A knowledge of the temperature relations existing between cold-blooded animals and their environments is of importance in all experiments having to do with the determination of temperature coefficients of the rates of reaction of physiological processes. If the relation can be shown to be a constant one it is necessary only to control carefully the temperature of the environment in order to have knowledge of the actual temperature of the animal or tissue under observation.

Tests made upon earthworms, clams, two genera of salamanders and upon the gold fish by means of carefully guarded thermoelectric measurements indicate that in general these animals adjust themselves to the temperature of their environment with remarkable exactitude, within a very short time, the difference being usually measurable only in thousandths or hundredths of a degree Celsius.

Observations on Regeneration and Division in Ciliates: GARY N. CALKINS, Columbia University.

A definite division zone, not affected by loss of parts through cutting, has been demonstrated in *Paramecium* and *Uronychia*. In *Paramecium* regeneration of enucleated fragments never occurs, while regeneration of nucleated fragments varies with the race used. In *Uronychia* regeneration of nucleated fragments always occurs, and regeneration of enucleated fragments varies with age of the cell when cut. If cut within eight hours after division the latter never regenerates; if cut within two hours prior to division it invariably regenerates into a perfect, but enucleate, cell.

Precocious formation of powerful cirri, before division, is characteristic of *Uronychia*. This, and regeneration, are phenomena of the same type, both functions of the fully differentiated protoplasm. The experiments indicate differences in protoplasmic make-up in young and old cells; and the increasing power of regeneration with age in enucleated fragments indicates an increasing differentiation. When fully differentiated, enzymes are formed leading to precocious organ formation.

Cell division occurs when differentiation has gone a step beyond that necessary for regeneration. Enzymes are then produced which bring about cytolysis of the specialized protoplasm in the division zone. Through tension of the cell the membrane turns in and the cell divides by constriction.

With chemical activities at division the protoplasm is restored to the labile undifferentiated condition of young cells. If this restoration is incomplete a progressive differentiation of the racial protoplasm occurs, leading to depression and death, which are prevented by drastic reorganization phenomena of asexual, and sexual, endomixis.

The Distribution of Water in the Embryonic Nervous System: O. C. GLASER, University of Michigan.

Embryonic nervous systems of *Rana pipiens* contain more water anteriorly than posteriorly. Donaldson has found in the adult a difference in the same sense. The determinations in the embryonic material were necessarily made with systems incompletely isolated from other tissues.

An indirect method, free from this objection, gives the same result. Nuclear volume varies with the water content of the cell. In the nervous system only relative nuclear volumes can be dealt with, but the evidence from thousands of nuclei shows that the anterior ones are larger than the posterior, not only during folding, but also in the flat neural plate.

In the theory of autonomous folding which I have tried to develop, absorption of water is a symptom of surface changes in the neural cells, and these changes are held responsible for the folding. If correct, and if nuclear size is an index of water content, then nuclei in the curling edges of the neural plate should be larger than those in the flat portions of the plate at the same level. This, as the detailed evidence to be presented shows, is true.

From the beginning, then, the anterior end of the vertebrate nervous system has a higher water content than the posterior, and the absorption of water accompanies folding.

The Comparative Resistance of Marine Animals from Different Depths to Adverse Conditions: V. E. SHELFORD, University of Illinois.

Benthic animals from different depths differ strikingly in their resistance to adverse conditions. Individuals of the same species taken from different depths show the same relations as do species living at the same or correspondingly different depths. In general animals from two fathoms are two to three times as resistant to fresh water and high temperature as animals from seventy-five fathoms. Animals from deeper water are usually more resistant to excesses of acid and alkali than those from shallower. The differences in physiological character within single species show the unreliability of conclusions regarding distribution based on the assumption that physiological characters are uniform for entire populations.

The Change of the Blowfly Larva's Photosensitivity with Age (illustrated with charts): BRADLEY M. PATTEN, Western Reserve Medical School.

Larvæ of the blowfly were tested each day from hatching until pupation to determine what, if any, changes take place in the degree of their photosensitivity. The test employed consisted in subjecting maggots crawling under the influence of a horizontal beam of light to an instantaneous change of 90° in the direction of beam. The resulting change in the direction of the animal's

locomotion was measured in degrees by means of a protractor. The more sensitive the individual was, the more closely did its deflection approach 90°. Using the same larvæ throughout the experiments, one hundred trails were run each day. The *average deflection* of each of these sets of 100 trails was used to locate a point on an "age-sensitiveness" curve.

The curve of photosensitivity thus obtained shows a rapid rise during the first days of larval life, reaching a maximum on the fourth day with a deflection of 81°, and gradually dropping off till the time of pupation, when the average deflection was 58°.

The Physiology of Chemoreceptors: W. J. Crozier, Bermuda Biological Station.

A comparison of quantitative measurements of cell penetrability for acids with the relative stimulating powers of these acids and with the limiting dilutions beyond which they are ineffective in stimulating earthworms and four species of marine animals indicates: (1) that an acid stimulates by union with a constituent of the ceptor surface, and (2) that this surface is not simple but complex and contains probably proteins and fatty substances.

Encystment of Didinium nasutum: Gary N. Calkins, Columbia University.

Encystment of *Didinium* under culture, with adequate food and normal conditions, is preceded by a declining division rate in the race as a whole. Encystment lasts for about six days, when the organisms emerge with renewed vitality, as shown by an average division rate from five to ten times greater than that prior to encystment.

During encystment the cell undergoes complete reorganization. The macronucleus degenerates into fragments which are ultimately absorbed in the protoplasm. The micronuclei swell and divide by mitosis, the products giving rise to new macro- and micro-nuclei.

This reorganization occurred twice during the history of my *Didinium* culture with an interval of six weeks. After the second period the race did not encyst again, but continued to live with a slowly decreasing division rate for about six months, when the last individuals died with characteristic symptoms of depression.

The individual *Didinium* isolated was evidently well advanced in its racial cycle. This is indicated not only by loss of powers of encystment and reorganization, but also by the fact that *after* the two periods of encystment, and for ten days only in each case, epidemics of conjugation occurred in the stock material derived from organisms which had recently encysted. Asexual reorganization, apparently, merely restored the protoplasm to a condition in which conjugation was possible; a condition which is, in itself, evidence of advanced differentiation, and a condition from which the protoplasm is restored through conjugation.

On Cell Penetration by Acids: The Effects of Anesthetics and of Stimulation by Induction Shocks: W. J. Crozier, Bermuda Biological Station.

1. Anesthetics produce a reversible decrease in the permeability of *Chromodoris* tissues toward a range of dilutions of strong acids. The magnitude of the effect depends upon the concentration of the individual anesthetic and the time of its action, and may prolong penetration time by 100–200 per cent. Following the decreased permeability there ensues an increased permeability, irreversible in its later stages, which can be antagonized (delayed) by balanced salt solutions. Cytolytic agents increase permeability toward acids.

2. Stimulation by induction shocks decreases the penetration time of acids. The decrease in permeability toward acids produced by anesthetics may be inhibited by simultaneous strong stimulation.

Behavior of Holothuria captiva Toward Balanced Illumination: W. J. Crozier, Bermuda Biological Station.

The whole surface of *Holothuria* is reactive to light. These animals are negatively phototropic. In *H. captiva* the two sides of the animal are sensibly parallel, and when subjected to bilateral illumination there is accordingly no possibility of equalizing the amount of light on the two sides by assuming a position perpendicular to the axis of the opposed beams, or, in case these beams are of unequal strength, by pursuing a path at some definite angle with this perpendicular. This is in accord with the behavior of *Holothuria* and proves that photic stimulation in this animal depends upon the amount of light falling upon the sensitive surface, and is independent of the *angle* of incidence. The fact that isolated portions of the skin react to continuous light is further and conclusive evidence that the direct action of light, not change of intensity, furnishes the stimulating agency.

Caswell Grave,
Secretary-Treasurer

(*To be continued*)